

What is claimed is:

1. The ternary block copolymer with penta-block structure represented by the formula (1), wherein the molecular weight is 50,000 to 400,000, pB has more than 70% of 1,4
5 structure, the content of pS is 5 % to 50 % by weight and pB and pI are in a weight ratio
of pB/pI \geq 1.



Wherein, pS is vinyl aromatic polymer, pB is polybutadiene and pI is
10 polyisoprene.

2. The ternary block copolymer of claim 1, wherein the vinyl aromatic polymer is a polymer of one or more monomers selected from the group of styrene, α -methylstyrene, *o*-methylstyrene, *p*-methylstyrene, *p*-*tert*-methylstyrene.

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3. The ternary block copolymer of claim 1, wherein the vinyl aromatic polymer is polystyrene.

4. The ternary block copolymer of claim 1, wherein the content of vinyl aromatic
20 polymer is in the range of 5% to 35% by weight.

5. The ternary block copolymer of claim 1 or in claim 4, wherein the molecular weight of the vinyl aromatic polymer is in the range of 8,000 to 20,000.

- 25 6. The manufacturing method of the ternary block copolymer comprising the steps of:

a) making living polymer by contacting vinyl aromatic monomer with organolithium initiator in an inactive hydrocarbon solvent until the monomer is fully consumed;

- b) polymerizing diblock living polymer by adding isoprene monomer to the
- 5 above living polymer and polymerizing until the monomer is fully consumed;

c) preparing tri-block living polymer by adding butadiene monomer, to the above di-block living polymer and polymerizing until the monomer is fully consumed; and

- d) conducting coupling reaction by adding coupling agent to the above tri-
- 10 block living polymer.

7. The manufacturing method of the ternary block copolymer of claim 6, wherein the inactive hydrocarbon is selected from the group of cyclohexane, the mixture of cyclohexane and n-hexane, and the mixture cyclohexane and n-heptane.

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8. The manufacturing method of the ternary block copolymer of claim 6, wherein an organolithium initiator is selected from the group of *n*-butyllithium and *sec*-butyllithium.

- 20 9. The manufacturing method of the ternary block copolymer of claim 6, wherein the coupling agent has two or more functional groups.

10. The manufacturing method of the ternary block copolymer of claim 6, wherein the coupling agent is selected from the group of dichlorodimethylsilane, dichlorodiphenylsilane, tetrachlorosilane, and their mixture.

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11. The manufacturing method of the ternary block copolymer of claim 6, wherein the coupling efficiency in the coupling reaction is in the range of 50% to 100%.

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